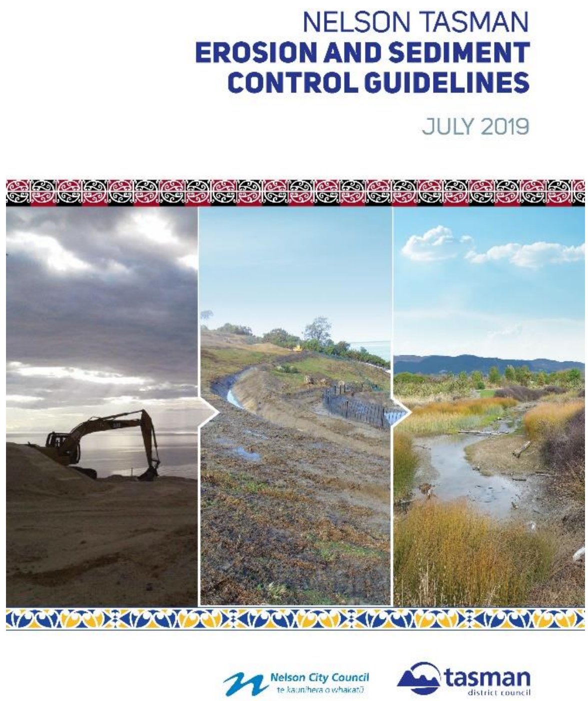
Chapter 5

Risk Management Approach to Erosion and Sediment Control



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5 RISK MANAGEMENT APPROACH TO EROSION AND SEDIMENT CONTROL

The likelihood that a land disturbance project could have significant adverse effects on the receiving environment is dependent on the following aspects:

- How long soil is exposed (duration of the works)
- The maximum exposed area of the works at any one time
- The use - or lack of – good site management practices
- The use and maintenance of effective erosion and sediment controls
- The slope and geology of the site (erodibility and sediment pathways)
- The location of the site and proximity of the receiving environments
- The chance of a storm occurring during the works which causes erosion and sediment transport off site.

The project manager has direct control over the first four points, and can use good onsite practice (refer Chapters 6 and 7) and a risk based approach to the design of erosion and sediment controls to minimise the influence of the slope, geology and the occurrence of storm events.

The potential for lasting effects (consequence) will depend on the sensitivity of the receiving environment(s) the site discharges to. Table 5-1 provides a general guide to the different types of receiving environments and their susceptibility to adverse effects from sedimentation.

Table 5-1 Receiving Environments and Sedimentation Issues

Receiving system	**Water Quality**
Estuaries	Highest potential effect
Water conservation order areas	Highest potential effect
Spring fed streams	Highest potential effect
Streams and Rivers	High potential effect
Karst	High potential effect
Wetlands	High potential effect
Lakes	Moderate potential effect
Open coast	Lower potential effect
Land	Lower potential effect

Take the time to consider which receiving environments Land Disturbance activities on your site could have an impact on and consider the pathways by which sediment may leave your site – no matter how small your site.

The scale of your Erosion and Sediment Control Plan (Chapter 7) should reflect the sensitivity of the receiving environments, the potential for sediment generation on your site and the pathways for sediment transport off your site, as a measure of your sites risk of causing sedimentation. For many environments, once damage is done it may be irreversible, so it is vital you get it right first time.

Where a discharge is to one receiving environment type which is close to a more sensitive receiving environment (eg to a stream which flows into a nearby estuary) there is an expectation that the risk assessment for the site will include consideration of the proximity of the more sensitive environment and that where practicable, use of the more stringent design standards is undertaken. Each site should be assessed on a case-by-case basis.

5.1 Levels of Risk included in Erosion and Sediment Control Design

Storm events are the primary cause of erosion and sediment transport off site. Short duration works may be lucky enough to be completed during a dry spell resulting in minimal opportunity for sediment pollution, however storms of any size can happen at any time in Tasman and even short duration works undertaken in the drier summer months may experience a large storm event resulting in significant off site discharges.

Key fact

The longer the duration of the works the greater the chance of a specific sized storm event occurring during the time that soils are exposed and vulnerable to erosion.

Due to the highly variable nature of rainfall (refer) and soils in Tasman, the Council has decided to utilise a risk based approach to erosion and sediment control design, based on the chance of a storm occurring during the works, the site characteristics and the sensitivity of receiving environments.

The Council considers this an equitable approach to management of works across the district as everyone provides for the same level of receiving environment protection. The level of acceptable risk selected seeks to strike a balance between the risk to the receiving environments and the practicability of erosion and sediment controls.

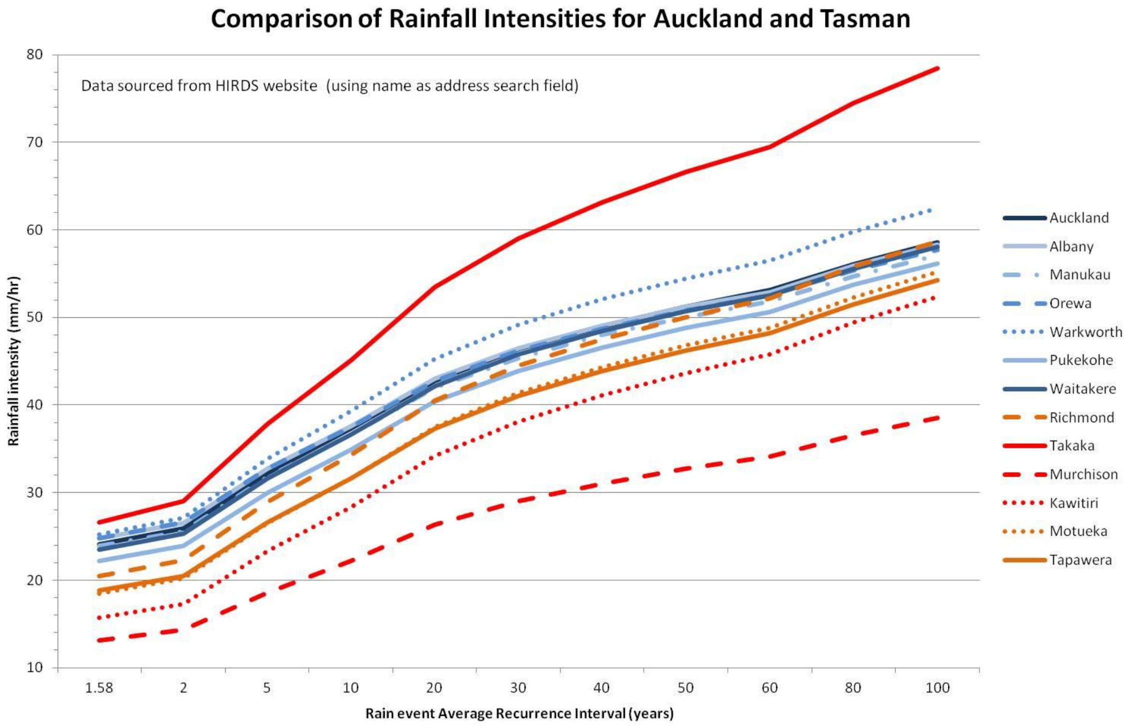

Figure 5-1 Comparison of HIRDS rainfall intensities for locations in Tasman (reds) and Auckland (blues)

Three categories of acceptable levels of risk have been identified for the different types of receiving environments. These give a 97.5% 95% or 90% level of protection of the respective receiving environments depending on their sensitivity to sedimentation (refer Table 5-4). Put another way these give a 2.5% (1 in 40) 5% (1 in 20) or 10% (1 in 10) chance of a storm event occurring within the works durations identified.

Most earthworks projects in the Tasman area take between six and 12 months to complete. Longer projects are often split into distinct stages of six or 12 months.

The probability (P, in percent) that a specific flood occurring during any time period can be calculated using the following equation:

$$P = 1 - [1-(1/T)]^n$$

'T' is the return period of a given storm threshold (eg, 100-yr, 50-yr, 25-yr), and
'n' is the duration of the works in years (MfE 2010).

For example in the table below: for works that are 12 months duration there is a 50% chance of experiencing a 2yr return event during the works, and a 20%, 10%, 5%, 2% and 1% chance, respectively, of experiencing 5yr, 10yr, 20yr, 50yr and 100yr ARI event.

Table 5-2 Risk based on Duration of Works and Storm Event Average Recurrence Interval (ARI)

Duration of Works	3mths	6mths	9mths	12mths	18mths	2yrs	3yrs	4yrs	5yrs	10yrs
Event Return Period	0.25	0.5	0.75	1	1.5	2	3	4	5	10
2	15.9%	29.3%	40.5%	50.0%	64.6%	75.0%	87.5%	93.8%	96.9%	99.9%
5	5.4%	10.6%	15.4%	20.0%	28.4%	36.0%	48.8%	59.0%	67.2%	89.3%
10	2.6%	5.1%	7.6%	10.0%	14.6%	19.0%	27.1%	34.4%	41.0%	65.1%
15	1.7%	3.4%	5.0%	6.7%	9.8%	12.9%	18.7%	24.1%	29.2%	49.8%
20	1.3%	2.5%	3.8%	5.0%	7.4%	9.8%	14.3%	18.5%	22.6%	40.1%
30	0.8%	1.7%	2.5%	3.3%	5.0%	6.6%	9.7%	12.7%	15.6%	28.8%
40	0.6%	1.3%	1.9%	2.5%	3.7%	4.9%	7.3%	9.6%	11.9%	22.4%
50	0.5%	1.0%	1.5%	2.0%	3.0%	4.0%	5.9%	7.8%	9.6%	18.3%
60	0.4%	0.8%	1.3%	1.7%	2.5%	3.3%	4.9%	6.5%	8.1%	15.5%
70	0.4%	0.7%	1.1%	1.4%	2.1%	2.8%	4.2%	5.6%	6.9%	13.4%
80	0.3%	0.6%	0.9%	1.2%	1.9%	2.5%	3.7%	4.9%	6.1%	11.8%
90	0.3%	0.6%	0.8%	1.1%	1.7%	2.2%	3.3%	4.4%	5.4%	10.6%
100	0.3%	0.5%	0.8%	1.0%	1.5%	2.0%	3.0%	3.9%	4.9%	9.6%

The frequency of storm events (ie the AEP, ARI or return period) within the typical work duration time frames has been identified to meet the desired levels of risk. These are summarised in Table 5-3.

Table 5-3 Flood Frequencies for typical land disturbance durations and desired levels of risk

Duration / **Risk**	**3 months**	**6 months**	**12 months**
2.5% (1 in 40)	10 yr ARI	20 yr ARI	40 yr ARI
5% (1 in 20)	5 yr ARI	10 yr ARI	20 yr ARI
10% (1 in 10)	2 yr ARI	5 yr ARI	10 yr ARI

These storm sizes represent the design storms required to achieve the desired level of protection for the different receiving environments. For storms that exceed these levels it is expected that specifically designed controls will be overwhelmed, and it is likely that there will be significant discharge of sediment from sites to receiving environments. This is an unavoidable residual risk.

The receiving environments, desired risk levels and design storms are summarised in Table 5-4. This table and risk approach is used in the design methodology for erosion and sediment controls requiring specific design outlined in Appendix 13.7.

Table 5-4 Receiving environments and design storms

Category	Receiving system type	Potential for Adverse Effects from Erosion and Sedimentation	Desired design risk (chance of event occurring during works)		Storm frequency (Average Recurrence Interval) to design for (1-hour duration) (Years)				
					Site disturbance Duration				
			%	chance	up to 2 weeks	up to 1 mth	up to 3 mths	up to 6 mths	up to 12 mths
A	Estuaries	Highest	<2.5%	1 in 40	2 yr	5 yr	10 yr	20 yr	40 yr
A	Water Conservation Order Areas	Highest	<2.5%	1 in 40	2 yr	5 yr	10 yr	20 yr	40 yr
A	Spring fed streams	Highest	<2.5%	1 in 40	2 yr	5 yr	10 yr	20 yr	40 yr
B	Streams and Rivers	High	<5%	1 in 20	*85% of 2 yr	2 yr	5 yr	10 yr	20 yr
B	Wetlands	High	<5%	1 in 20	*85% of 2 yr	2 yr	5 yr	10 yr	20 yr
B	Karst	High	<5%	1 in 20	*85% of 2 yr	2 yr	5 yr	10 yr	20 yr
B	Lakes	Moderate	<5%	1 in 20	*85% of 2 yr	2 yr	5 yr	10 yr	20 yr
C	Open coast	Low	<10%	1 in 10	*85% of 2 yr	*85% of 2 yr	2 yr	5 yr	10 yr
C	Land	Low	<10%	1 in 10	*85% of 2 yr	*85% of 2 yr	2 yr	5 yr	10 yr